Zero Retries issue 0037 2022-03-11

Advanced Amateur Radio - Data Communications; Space; Microwave… the fun stuff! The Universal Purpose of Ham Radio is to have fun messing around with radios - Bob Witte K0NR. Ultimately, amateur radio must prove that it is useful for society - Dr. Karl Meinzer DJ4ZC. We are confronted by insurmountable opportunities! - Pogo. Nothing great has ever been accomplished without irrational exuberance - Tom Evslin. Irrational exuberance is pretty much the business model of Zero Retries Newsletter - Steve Stroh N8GNJ.

Zero Retries is a unique, quirky little highly independent, opinionated, self-published newsletter about technological advancement in Amateur Radio, for a self-selecting niche audience, that's free to subscribe to.

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor

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Request To Send

Countdown to Hamvention 2022 - May 20-22, in Xenia, Ohio - 10 weeks…

Substack, the platform used to publish Zero Retries, continues to improve its systems, and a recent improvements is a cleaner landing page, that includes an About section. this week, I updated the generic ("Join the team…") boilerplate language originally found there. I was going to include my witty new "About" verbiage here in Zero Retries, but as I did, the now familiar warning appeared: *"**Post too long for email**"*. You'll have to click the link, but as reward there are some fun bits there, including some backstory on Zero Retries.

One of the things that I'm proudest of with Zero Retries is not only that Zero Retries subscribership continues to grow, some folks who subscribe to Zero Retries later unsubscribe. To me, that means that Zero Retries is working as I intended - a niche publication for a self-selecting audience. The subjects I talk about in Zero Retries (and the way I talk about them -

highly opinionated) aren't going to resonate with everyone, and thus no points off / no angst on my part for the "unsubscribers". For those of you reading this (choosing to remain subscribed), *Thank You* and more interesting times are ahead for you and I; details will be provided as soon as I can talk about new developments without overflowing an issue.

de Steve N8GNJ

Banquet Speech by Lyle Johnson, WA7GXD

From the ARRL and TAPR 1996 Digital Communications Conference
Seattle Washington, September 21, 1996

Transcribed by Steve Stroh, N8GNJ
~~Audio and photos are available on http://www.tapr.org~~

In writing Zero Retries 0035, I dug into my past experience for a poignant quote from this speech, and I was struck, yet again, just how prescient, how clearly KK7P (then WA7GXD) saw the issues with Amateur Radio's technological evolution so clearly. It's almost (the mention of then-current PCs didn't age well) like this speech could have been given last night - it's still that relevant. Thus I'm including KK7P's entire speech here in Zero Retries.

My thanks to Phil Karn KA9Q for a very good quality scan of the TAPR Packet Status Register Fall 1996 Issue #64. The "official" archival scan of that issue on the TAPR website is completely unreadable. Below is excerpted from the Fall 1996 issue of TAPR PSR. The quote in bold about mid-speech is the portion I mentioned in Zero Retries 0035. I cleaned up minor typos…from the scan, or from my original transcription.

Well, as you can probably tell, this is the first time I've ever done one of these, so I want to thank everybody for the opportunity to do this. I want to thank Greg Jones, WD5IVD, for inviting me. What I understand the ground rules on this are that: if this goes over OK, Greg gets the credit for his wisdom; if it doesn't, it's my fault And besides that, I know you're really here for the prize drawing so I'll try and keep this short.

My personal involvement with TAPR (heavy involvement, that is) on the board and as an officer and so forth, ended about three or four years ago. I left at that time feeling it was really time for some new blood with a new organization, new directions of leadership. Four years ago when I left, I was very, very proud of TAPR and what it had accomplished. And today I can honestly say that I'm just as proud of what it's still doing and I want to thank Greg for doing an excellent job. (Applause)

We have a number of students with us this year. I understand with the first ever student awards that some of these students may not be terrifically familiar with Amateur Radio. So, I'm going to touch on a few things that may seem a little bit basic; for them it's new, for the rest of us it's a refresher.

One of the points I want to make is that we must keep in mind that Amateur Radio is a Service that we have under the FCC. We often talk about this wonderful hobby that we have, but hobbies are like tying fishing flies. This is a Service, it's licensed by the government, under

government regulations.

And one of the things that strikes me about this is that the public has entrusted us with billions of dollars worth of spectrum. Some of it's exclusive, some of it we share with other services. But, we're finding out more and more these days that the public is expecting its money's worth. And remember that the public that's granting us this priviledge is the same public that brings lawsuits about our big antennas in our backyards.

So the Amateur Radio Service was formed in the Communications Act of 1934. There was a basis and purpose for it and there are four (if memory serves me correctly) basic pillars or precepts upon which our Service is formed. One of them would be public service, emergency communications, things of that nature. Another is to provide a trained reservoir of technicians and operators in times of national emergency. A third is to advance the radio art, and the fourth is for international goodwill.

And the thought struck me the other day when I was wondering about what should I talk about to this group of people. I was wondering, "This is 1996, not 1934. Would the FCC establish the Amateur Service today, in today's climate?" If we weren't trying to preserve what we had, but trying to carve out something new, would they take spectrum from someone else and give it to us? And if they would do it today, would they do it ten years from now or fifteen years from now? I got to thinking about that a little bit And in 1934, public service communications radios were fairly rare (in 1934) and Amateur Radio could step in and do quite a lot. In 1996 we still provide public service but I think the public is a little bit less dependent upon us now than they were in 1934. What about the year 2010?

In terms of providing technicians and operators, certainly in 1934 it was a wise choice. In 1940,1941-42 we went to war and a lot of the same equipment that was in our ham shacks wound up on the front lines and the same people operating that same equipment In 1992 with Desert Storm, I'm not sure how many hams were invaluable in Desert Storm. I'm not sure what would happen in 2010 if, God forbid, we had to fight another war.

In terms of international goodwill, in 1934, we've all seen the Indiana Jones flicks- everybody climbs on a Pan Am clipper, all eight passengers, and they fly for days to get across the Pacific ocean stopping for fuel at every passing boat. Today, travel is inexpensive; it costs pennies instead of dollars now. Everybody travels; it's ubiquitous. Last week at this time I was on my way to Brazil on business. I left on Saturday, I was in Brazil Sunday and Monday and part of Tuesday and I was back at my desk Wednesday afternoon before I came here Wednesday evening. Travel — it happens. We get international goodwill now by face-to-face meetings rather than necessarily by Amateur Radio.

And what about advancing the radio art? Certainly in 1934 we contributed a lot. In 1996, I think we're still contributing, but it's somewhat less. But I wonder about what might happen in 2010.

To touch some of these points again...

In terms of public service, I remember when my brother was stationed at government expense in a beautiful tropical paradise near the Cambodian border. And he was able to call home from time to time through something called MARS - the Military Affiliate Radio System, which was

basically Ham Radio. And he called home and we got to talk to him for sixty seconds or one hundred and twenty seconds and then it was the next GI's turn. But in Desert Storm the phone company just put phone booths out in the desert and people just direct dialed home. MARS wasn't terribly relevant then.

Nowadays when a disaster hits, another hurricane hits the East Coast, a twister hits the Midwest, the infrastructure gets damaged. When that happens, the hams step in and they provide emergency communications. How long do they provide that for? Months? Years? No, until the technicians fix the commercial infrastructure, then the commercial services take over again. Why? Because they're more efficient.

So, what's going to happen in a couple of years when Iridium will be here, the little LEO satellites get launched, and now you can grab your cell phone and you can directly link with the satellite, and the infrastructure doesn't get damaged when a hurricane occurs. How meaningful are we going to be at that time? If you're driving down the road and you see an accident, you grab your two meter radio, you bring up the phone patch, but four other people have already driven by with their 900 MHz handhelds and they've already reported the accident by direct dialing 911. So I think that if we look today, and towards the future, that one of those pillars that has held Amateur Radio up, that of Public Service, is going to be providing diminishing returns to the public in terms of these billions of dollars of spectrum that they're authorizing us to use.

What about trained operators and technicians? This afternoon we were down there looking at this really neat Kenwood, what is it? A TS-870 radio with dual digital signal processors. How many people here can fix it? How many people here think Kenwood can fix them?

How many people have an HF radio with Automatic link Establishment protocol built in that they use in Amateur communications? Not too many. (What I'm trying to point out is that there's a divergence between what we use and what the government or the military might use.) How many of you have set up a satellite ground station? How relevant is our experience to areal-time graphics display in an Abrams tank or a Bradley fighting vehicle that's rolling over a battlefield with all the enemy and all the good guy positions all illuminated on there for their fire control systems?

In Desert Storm, there were some thin route communications used on the front lines that were based in some degree on Amateur-developed technology in TNCs and so forth. We did make a contribution to Desert Storm, but it was in technology more than it was in people.

In terms of international goodwill, I think I already touched on the fact that travel nowadays is cheap and Americans go everywhere all the time. I'm not sure how much international goodwill is promoted when you turn on twenty meters on any weekend you want to pick and hear "CQ Contest" or "Hello Contest".

If you were the public — if you were the administrator — would you be willing to give up a billion dollars of public spectrum for what you hear on the HF bands in terms of international goodwill? I'm not saying what we're doing is bad, I'm simply wondering, within the perspective of the billions of dollars that we're now faced with, what will we do?

So, to me, the pillar that's left, the strong one, is advancing the radio art I think that's what we

have to build our case upon. I don't think that we can build a strong case upon other things in the future, although we can to some degree today. Clearly, that's what the DCC is all about, that's what TAPR, AMSAT, AMRAD, and the ARRL is heavily involved in, that's what we do, that's what we're involved with—trying to advance the radio art But to do the radio art, you need radio, right? You need spectrum. OK? So we can't waste the spectrum.

Now, a fellow at work a few weeks ago handed me a book that I read (I must have been terribly bored). The name of the book was "God Wants You To Be Rich" by Paul Pilzer. What does that have to do with radio spectrum? Well, this fellow that wrote this book had a strange view of economics. He didn't believe that economics was "handing out scarce resources," he felt there were abundant resources. And he made three points that kind of stuck with me.

One of them was, he gave an example of a ketchup factory in the Midwest And this ketchup factory used to employ, I don't know, a gazillion people, now I'm sure they employ half a gazillion. But they didn't just make ketchup, they made the glass bottles, they made the labels, they printed them, they screwed the caps on them, they owned a fleet of trucks to distribute the ketchup around and they started being eaten alive by their competition during the 1980s. They shifted things a little bit and found a company that made plastic ketchup bottles cheaper than they could make glass ones. So they started buying plastic bottles. They found another company to make labels cheaper than they could make labels, and they found that they could contract with a trucking company cheaper than they could truck it themselves. In the end they wound up making more profit, selling more product, at a cheaper price, with a leaner organization because it became more efficient.

How is this related to what we're talking about?

Well, a lot of times I hear a real hue and cry when we talk about Amateur Networking, and "we've got a local area net over here in Tucson," or maybe "they've got their local area net in San Diego and this is Amateur Radio and we've got to tie these together by radio - we've GOT to use radio!"

Well, people just sort of make sure nobody's looking and connect it up to the Internet, and BOOM - they create a wormhole and we get messages across. Well, what's going on here? Well, we're being more efficient - we're subcontracting out those services that can be more efficiently provided by others and focusing on the things that we can do well. I think there's some relevance there. We could raise up our hands and say "that's not Amateur Radio," but maybe it doesn't have to be Amateur Radio to CONTRIBUTE to Amateur Radio.

Another point this fellow made was that nowadays we're creating wealth from absolutely nothing. Well, you say "What are you talking about, Lyle?" Well, there's a couple of things.

In the 1800s, there was a kind of a crisis that occurred because they realized that the Yankee Clipper Ships were going out there and taking out the whales faster than the whales could make more whales. And this was a problem because everybody lit their house (back in those days) with whale-oil lamps. And how were they going to have light for their children or grandchildren if we killed all the whales? So they decided that maybe we should cut back on the hunting a little bit, or this or that.

But, a couple of things happened in the meantime. There was this guy named Edison, and he

got some bamboo filament, and this and that, and he made an electric light bulb. “Hmmm, this might have some applicability to saving the whales?” Another fellow went walking around, he was in Pennsylvania somewhere I guess, and noticed there was this perfectly good farmland that “Gosh, it’s mined! There’s this slimy black stuff that’s kind of oozing out of the ground here.” Well, there’s petroleum! Now, we don’t want our houses lit with whale oil lamps. But tremendous wealth has been created with electric light bulbs, and with petroleum. Well, now we’re running out of petroleum - but maybe technology will find another answer to this.

Twenty years ago there wasn’t any viable PC industry in this country, but today the PC industry is roughly on par with the automotive industry in terms of its contribution to our economy. We’re talking about an industry that did not exist twenty years ago!

And what is the PC industry, this tremendous wealth, what is this based on? Sand. Silicon - the most common element there is on our planet - silicon. But that’s what a huge fraction of our economy is now based on, something that we walked out on and just shook it out of our shoes and walked down the beach and didn’t worry about it much.

Well, what do we need? We need spectrum. How are we going to get that spectrum? Maybe we’re going to get it by applying technology in ways that we haven’t applied it before to create, in effect, more spectrum.

Another point this fellow made in his book was the accelerating pace of change. He pointed out that in the 1930s there were tens of millions of people that were involved in agriculture in this country. And each farmer could feed his family and two or three others. Now, in the 1990s, we have just a few million farmers, but each farmer can feed his family and about a hundred others. Farmers are far more efficient.

Well, that’s great for those that are still farmers, but what about those tens of millions that aren’t farmers anymore - what did they do? Well, over a period of a few decades, as this revolution was occurring, they moved to the cities. And what did they do? Well, some of them went to factories in the automotive industry and built carburetors. And others went to die recording industry and built vinyl LPs.

And then what happened in the 1980s? We went from employing a million or so people making carburetors in this country to nobody making carburetors. Why? Because we’re using electronic fuel injection. And what about the people making vinyl LPs? in 1983 they had a job. In 1985 they didn’t Why? Because ofthe Compact Disc.

We’re going through changes where, in the past, it took a generation or so for a major change to occur, to where my children are going to probably face two or three major changes in their career growth during their normal working lifetime. Something we’ve never had to deal with because of the incredible accelerating rate of the advancement of technology.

In the 1950s and 1960s when I went to school, nobody ever heard of the PC, we didn’t care much about sand, what was good for GM was good for the nation. We had slide rules, log tables, and ham radio. My kids went to school in the 1980s and 1990s and what did they use in school? Graphing calculators, and they hook up to the World Wide Web. They take their tests electronically at home, they do their homework electronically and e-mail it in to their teacher. What’s going to happen with my grandkids? I don’t know either.

In the 1970s, or up to the 1970s the U.S. economy was based on manufacturing. Today, our economy is based on information and services. As Greg pointed out in his latest PSR editorial, it's a paradigm shift - looking at things completely differently. It's like "Dead Poet's Society" where everybody stands on the desk and looks around. It's a different perspective on life. We worry about the loss of manufacturing. Well, gosh! Japan made six billion dollars worth of VCRs last year. Yeah, but Hollywood made SIXTY billion worth of movies for those six billion dollars worth of VCRs.

Well, let's shift gears a little bit and gaze at the digital Amateur station of ten years ago. It's 1986 - most of us can still remember back that far. You had an 8088 or 80286. 1986 - OK, maybe you had a Mac as well. You had a megabyte of DRAM, you had a forty megabyte hard drive, you had an EGA monitor (how many remember EGA monitors?). You had a Z80 TNC with a 1200 baud modem plugged into the audio jacks of your two meter radio, and you had a 1200, or if you were rich, a 2400 bit per second connection to The Source, or maybe CompuServe.

Let's look at that same digital Amateur station today. It's now 1996. You've got a high speed 486 or Pentium, it's got at least eight megabytes of RAM, you've got a one gigabyte hard drive and a SuperVGA monitor. You've got a 28.8 kilobit modem that cost $99 connected up to your $20 per month Internet connection. And you've got a Z80 TNC running at 1200 bits per second connected to your two meter radio. (Laughter)

What's wrong with this picture?

Advancing the radio art is how we're going to retain what we have. Let's look at something else. Pretend it's 1944 now (I think most of us will have to pretend). If you ran into QRM on the frequency, well, what would you do? You'd QSY, change frequency, you'd QRZ, be sure the frequency was clear, and then you'd call CQ. What do we call that?

Frequency Division Multiplexing. We got a problem, we change frequency. In 1954, you know, 10 years later, Single Sideband was starting to come on past the Dan Norgaards and so forth and was up to the Wes Schuns and the Central Electronics guys. And you had Single Sideband, you cut your spectrum in half so you could put twice as many people in the same amount of spectrum. It was still FDM, right? In 1996, we're using what? Single Sideband. Same as we were using in 1954. It's nearly fifty years later. We're still using the SAME techniques.

In the 1970s, FM repeaters suddenly took over the landscape in Ham Radio when it went from basically zero in 1970 to five thousand today (and I imagine that eight years ago it was four thousand, nine hundred and fifty). What happens today in 1996? You go to Ralph, your local frequency coordinator, and say "Ralph, I need a frequency for my repeater" and Ralph just kind of says, "What else is new?" Right? There aren't any.

So Ralph, your local frequency coordinator, he's empowered as a kind of a God now. He can hand out these frequencies — these frequencies that are worth millions and millions of dollars. Ralph controls them now. And Joe Ham, who's a repeater owner, carefully warehouses that spectrum. He doesn't use it much but he wants to be sure nobody else can use it either, so he has his frequency coordination thing. Meanwhile he goes to another channel that Ralph gave him so he can run his remote base on the mountaintop so he can call CQ DX. And that's cool, that's good.

But somebody else went up to a local mountaintop with a spectrum analyzer one day and they scanned two meters. And they noticed that "I can't get a repeater allocation. Yet, if I scan this band and make a graph over twenty-four hours, I'll find that this band is maybe being used five percent." Maybe in our area it's being used twenty percent, but I doubt it.

There's something wrong here. So we're very busy organizing things so we can warehouse spectrum with closed repeaters that other people can't use. There's something wrong here I think. Does this sound like a good idea to you? That we promote this, we organize ourselves around this, and we defend this?

Now if you were a public policy maker, how would you feel about this? How would you react to the creation of this kind of a Service? Neither would I.

Well, now we've got this what we call the Little LEO controversy — the low earth orbiting guys. And they sat up there with their spectrum analyzer and noticed the same thing. So, now they've gone to the policy makers, and amongst the candidate bands (and we've all read the QST editorials) there's two meters and seventy centimeters on the table for consideration. Not to be taken, but to be shared. And we're treating this, and I suppose properly, as a call to battle — we have to battle those little LEO guys. "We can't possibly let them share our spectrum - this is our sacred stuff." Joe's gotta have his warehouse because Ralph gave it to him, right?

I don't look at this so much as a call to arms, I think it's a wakeup call.

I think that if we look at ourselves objectively, we have to say that we're grossly inefficient and that we're wasteful. We've been given a precious public resource and we're not utilizing it properly. Now the Little LEO guy can put his Spread Spectrum satellite on top of two meters and claim that he's not going to interfere with us, and he'll accept whatever we can dish at him because he knows how to handle it. Well, it's hard to argue that we're not going to share this underutilized resource with you because Ralph said it belonged to Joe... And I believe that this coexistence has been demonstrated to some extent with the STAs that were mentioned earlier in the Spread Spectrum talks today.

Well, it seems to me we have a choice here. We can either share our frequencies with the Little LEO guys, or we can share it with ourselves. If we don't share it with ourselves, we're going to have to share it with somebody else that might not be of our own choosing. So, it seems to me that we need to push, really, really hard. And TAPR is doing this, and the League is doing this, we need to push really hard to get the Spread Spectrum rules relaxed. How relaxed?

My feeling of how Part 97 should read is easy — "Here's your band limits. Have a nice day." I think we could fit the whole of Part 97 on this side of this three by five card in large type. So that even a bifocal guy like me could read it without glasses.

Well, let's go back to the little Z80 TNC that I talked about.

If you look in your Proceedings that you received today, and I think everyone here got one, you'll notice on page 145, and again on page 177, there are articles in there for an L band and an S band digital transceiver. Runs at 1.2 Megabits per second. It's pretty slick. These were designed by Matjaž Vidmar [S53MV]. Now Matjaž is a sort of down-the-totem-pole level professor. Whatever an entry-level professor in Slovenia (I don t speak Slovenian, I'm not sure

if anybody here does) is called. He did this at the University of Slovenia. Can anybody locate Slovenia quickly on a globe? There are a few that can. Alright, that's good. Most people, if you said Slovenia, they wouldn't know where it is.) Now, this is not a wealthy guy with a cadre of highly-paid highly technical people under him, and the economic powerhouse with highly technological infrastructure of Slovenia that dominates Europe today. This is a guy that's working in his house, making circuit boards, drawing pictures, using X-acto knives. But in a smaller European country, he is sharing with us this development that he has of a 1.2 Megabit radio. I remember, several years ago, we tried to make a 9600 bit per second radio, and we just sort of never did that.

So, granted, Matjaž is a very bright guy. But there are a lot of other bright people around here. What I'd like to see is TAPR, just as we revolutionized things with 1200 baud many, many, MANY years ago, or helped contribute to that, I'd like to see us revolutionize things at a Megabit And I think we can do it — the plans are right there, they're right in the book — that can cost a couple of hundred dollars to build. I held it in my hand last October when I was in Germany. I met with Matjaž as we were working on the Phase IIID project. Incidentally, that design that he has there is the basis of the 153.6 kilobit PSK modem that's going to be riding onboard RUDAK in Phase IIID, that's going to have Phil's convolutional encoder on it.

So, I think the stuff isn't magic, certainly. I think that, in my opinion, the only surviving basis that we're going to have over the next years for retaining our spectrum is technological advancement. I think we need to keep pressing on. I think we need to be very aggressive. I think with the rate of change and pace of change we need to be less conservative and more assertive. I think we need to expand our participation, speaking from a TAPR viewpoint, in the FCC and ARRL processes, and I know that TAPR is doing that. I think we have to press HARD for Spread Spectrum. We need to develop radios, we need to put them in people's hands just like we did with the Beta Test in 1982 with TNCs. I'd love to see a Beta Test in 1997 of Spread Spectrum radios to get out there into the Amateur community. I'd like to see us pushing the bit rates faster and faster.

Above all, I want to see us have a lot of fun. Because this is an Amateur Service - we're not allowed to make money at it so we might was well have a good time.

Thank you very much.

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There is so much to unpack here… again. My (extended) commentary in the next issue of Zero Retries.

ZR > BEACON

- Jason Oleham KM4ACK, author of Build-A-Pi1 claims to have demonstrated in a YouTube video that it is possible to run VARA FM on a Raspberry Pi. Unfortunately, he didn't provide any detail)other than the Raspberry Pi in question is running a 64-bit OS) either in the video or the comments. It's apparent either Windows or a Windows emulator is being used.

- **Crowd Supply: Announcing LimeSDR Mini 2.0**

  > LimeSDR Mini, the smaller, two-channel sibling of LimeSDR, is being retired due to ongoing supply chain shortages. In its place, we will soon launch LimeSDR Mini 2.0.

  This seemed to be the best technical commentary on the change:

  As of mid-2021, the price of the LimeSDR Mini (original) was $199.

- Thomas Epperly NS6T offers a very nice web-based utility to generate a customized "Azimuthal Map" for your location. In such a map, your location is literally the center of the world, with the rest of the planet spread out around you, making it trivially easy to determine the bearing to aim your directional antenna at other parts of the world. This looks like fun! Make some for friends.

Feedback Loop

Argh! Zero Retries 0035 generated a great round of feedback… and there isn't room to run any of it in this issue due to the length of the primary article. All that great feedback (and your faithful Editor's witty and pithy responses) are queued for the next issue of Zero Retries.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Closing the Channel

- In its mission to grow Amateur Radio and make it more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex!

- My ongoing Thanks to Tina Stroh KD7WSF for, well, *everything* and Bill Vodall W7NWP as *Zero Retries Instigator in Chief*.

- My ongoing Thanks to pseudostaffers Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" type items, on their respective blogs, from Amateur Radio and beyond, that I don't spot on my own.

- Southgate Amateur Radio News consistently surfaces "Zero Retries Interesting" stories.

- The Substack email publishing platform makes Zero Retries possible. I recommend it for

publishing newsletters.

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All previous issues of Zero Retries are available without restriction (no paywalls). For some background, Zero Retries 0000 was the **Introduction Issue**. Zero Retries 0026 and Zero Retries 0027 were a **2021 Year End Review** of Zero Retries.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ (He / Him)
These bits were handcrafted in beautiful Bellingham, Washington, USA
2022-03-11

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1

Build-a-Pi will allow you to get up and running fast with a Raspberry Pi for ham radio. Rather than downloading a pre-built image where you have no choices in the build, Build-a- Pi gives you complete control over the build. It allows you to choose the applications you want to install and skip the ones you don't need. This keeps your pi as lean and mean as possible.